The Future of the Improved Performance Research Integration Tool (IMPRINT)

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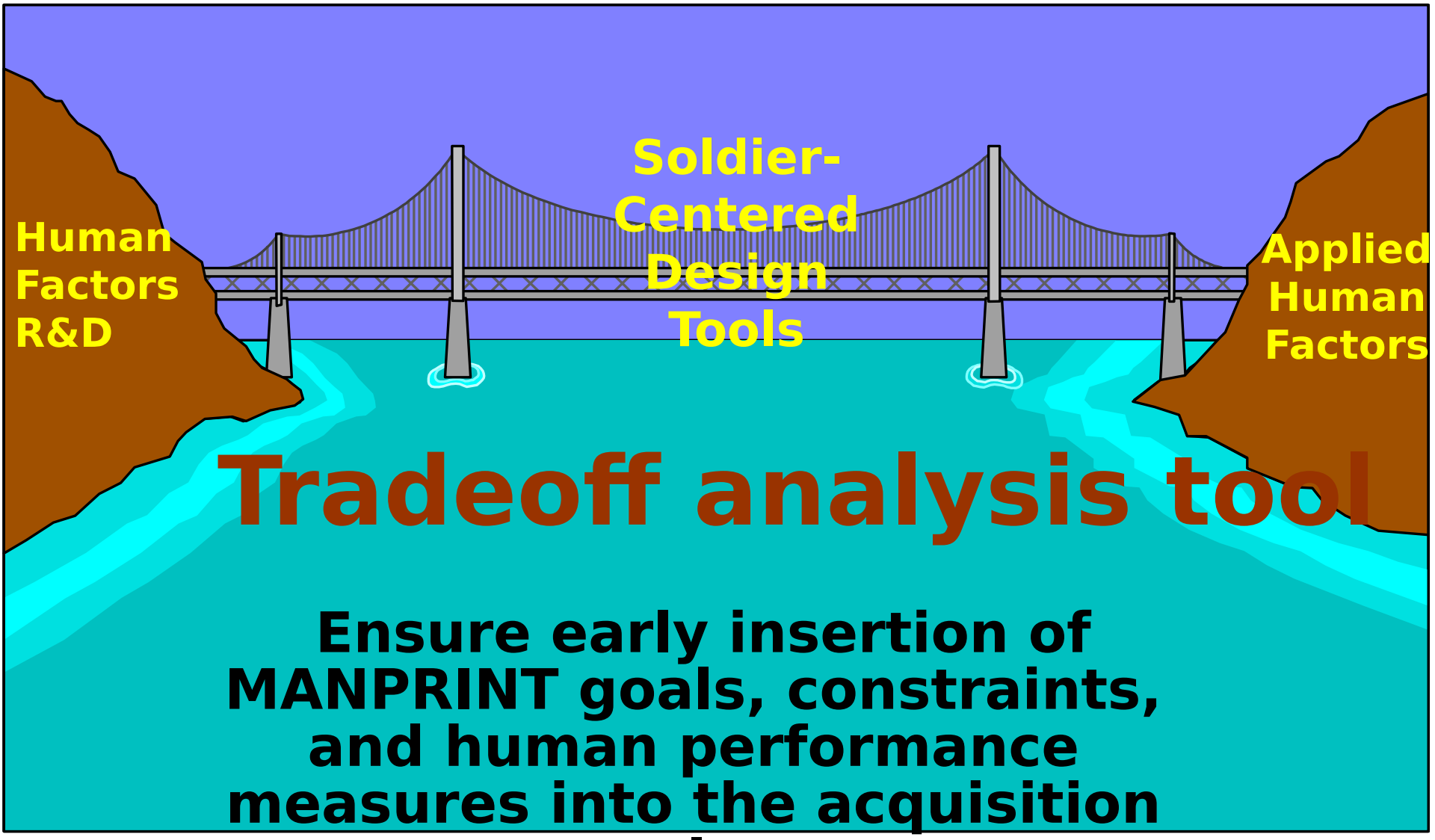
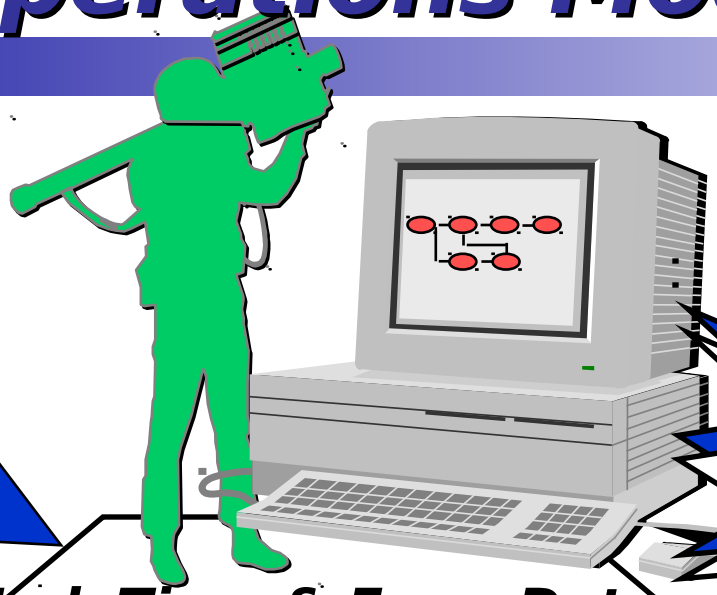
Improved Performance Research Integration Tool (IMPRINT)



Tradeoff analysis tool

Ensure early insertion of MANPRINT goals, constraints, and human performance measures into the acquisition

IMPRINT Architecture - Operations Modeling



Unit & Force

Task Libraries

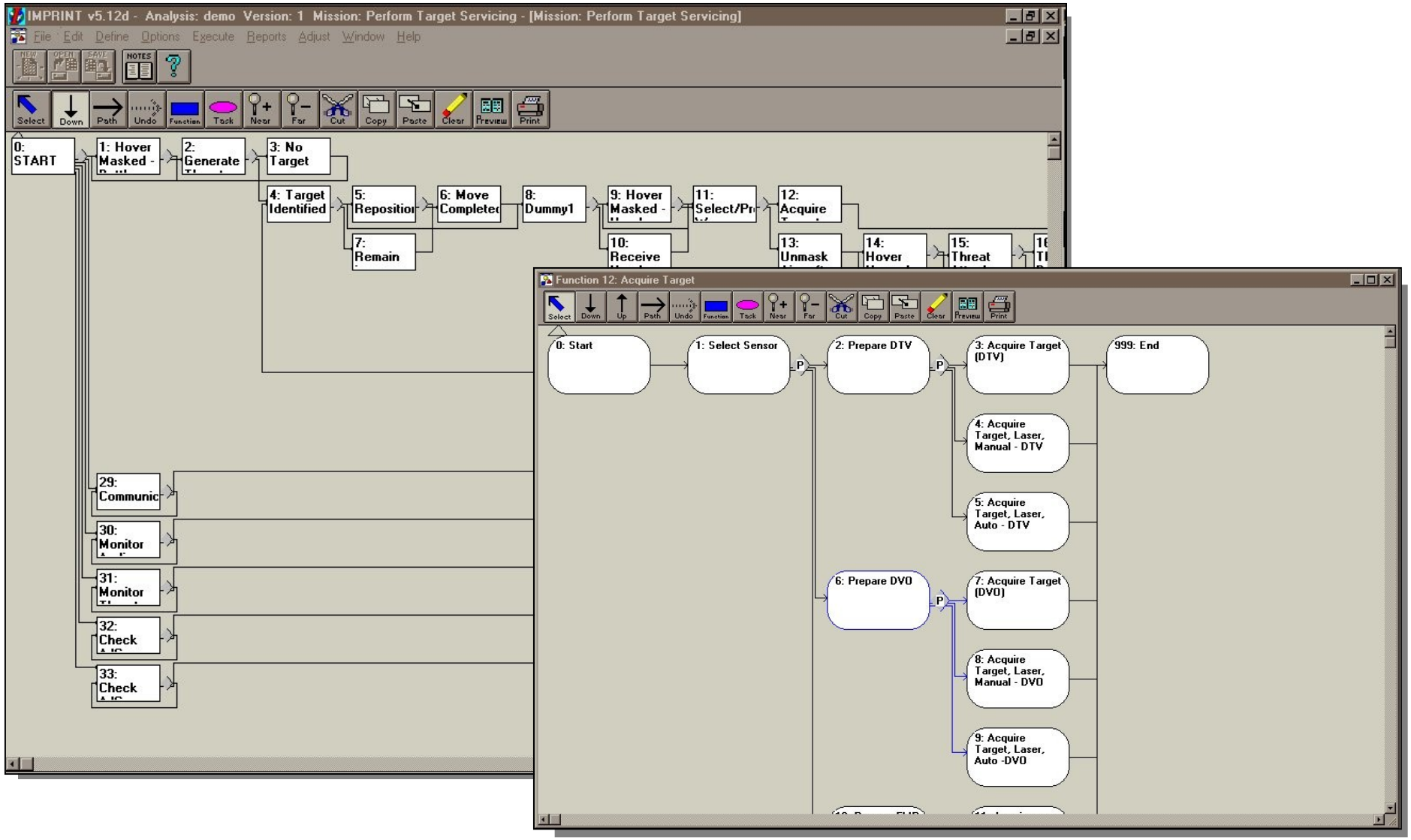
System Measures

Task Time & Error Data - Estimates & Requirements

Workload
Future Manpower
Performance Shaping
Functions
- personnel
- training
stressors

Stochastic Discrete Event Simulation

Improved Performance Research Integration Tool (IMPRINT)

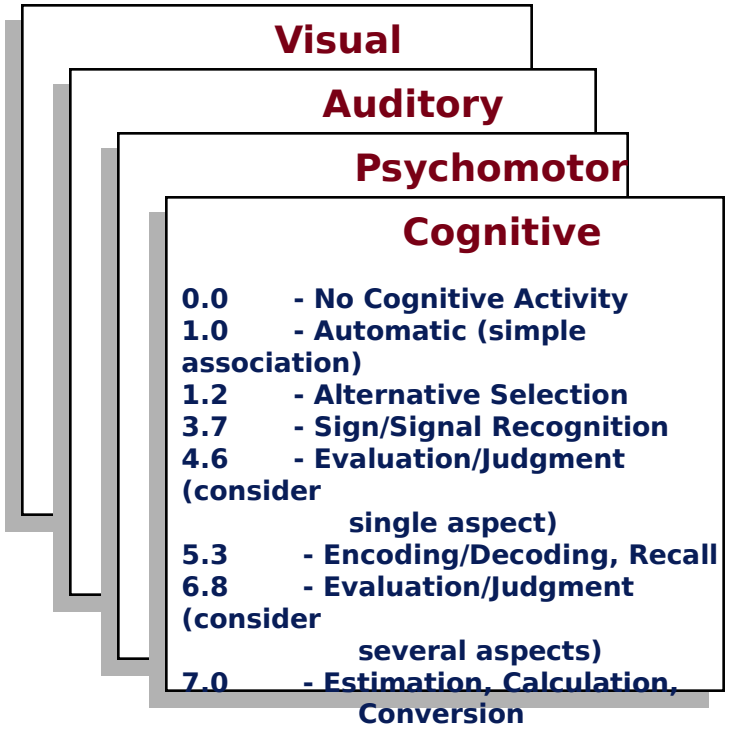

IMPRINT v5.12d - Analysis: demo Version: 1 Mission: Perform Target Servicing - [Mission: Perform Target Servicing]
File Edit Define Options Execute Reports Adjust Window Help
Select Down Path Undo Function Task Near Far Cut Copy Paste Clear Preview Print
0: START
1: Hover Masked -
2: Generate
3: No Target
4: Target Identified
5: Reposition
6: Move Completed
8: Dummy1
9: Hover Masked -
11: Select/Pr
12: Acquire
7: Remain
10: Receive
13: Unmask
14: Hover
15: Threat
29: Communic
30: Monitor
31: Monitor
32: Check
33: Check
Function 12: Acquire Target
Select Down Up Path Undo Function Task Near Far Cut Copy Paste Clear Preview Print
0: Start
1: Select Sensor
2: Prepare DTV
3: Acquire Target (DTV)
999: End
4: Acquire Target, Laser, Manual - DTV
5: Acquire Target, Laser, Auto - DTV
6: Prepare DVO
7: Acquire Target (DVO)
8: Acquire Target, Laser, Manual - DVO
9: Acquire Target, Laser, Auto -DVO

Mental Workload

Mission Tasks → **Which Brain Resources Involved?** → **Degree of Resource Use?**

1. monitor alarms
2. decide response action
3. pull trigger
.
.
.
n. task n

- **Visual**
- **Cognitive**
- **Auditory**
- **Psychomotor**



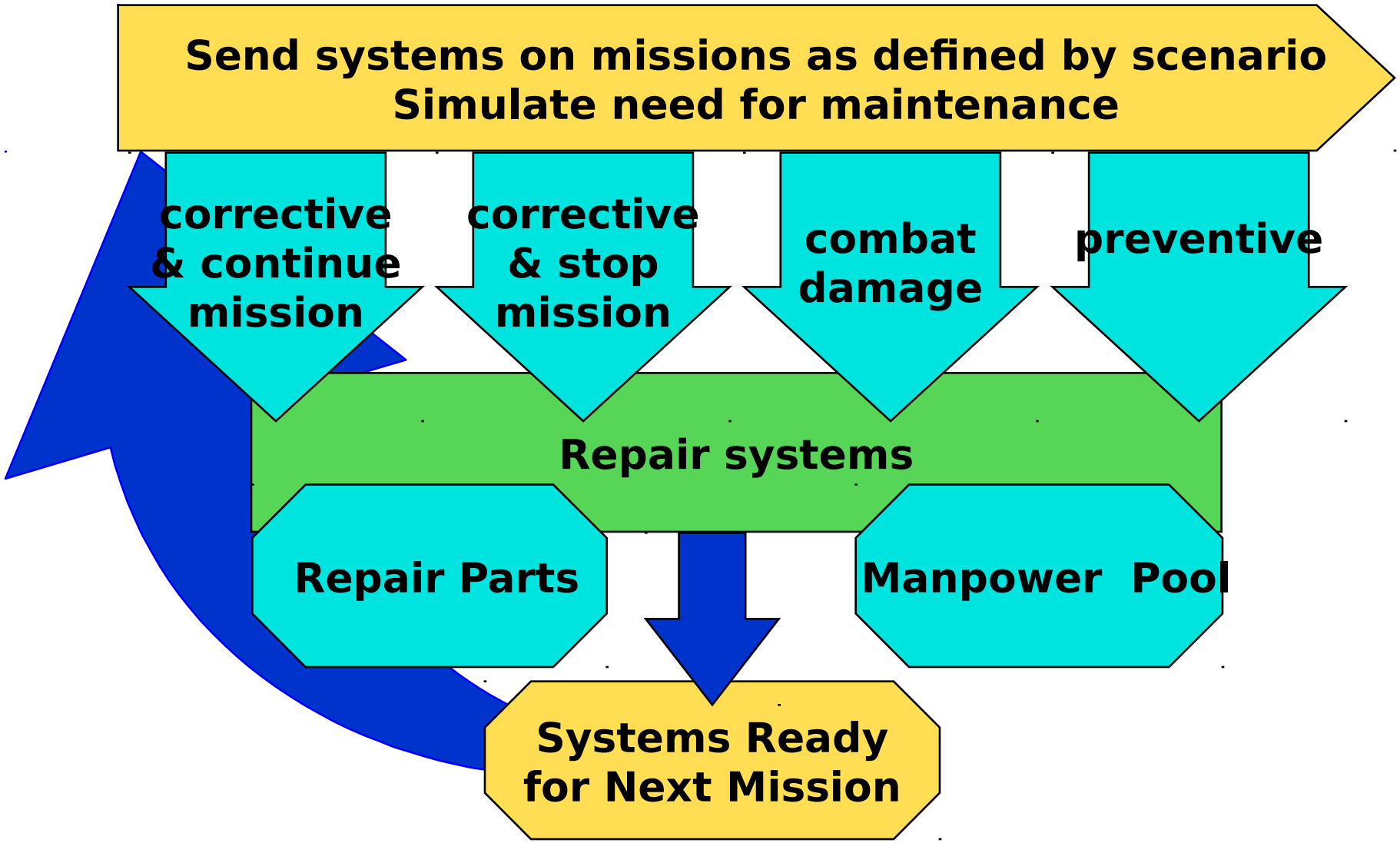
Current IMPRINT Implementation: Stressors by Task Type

Task type (Taxon*)	MOPP	Heat	Cold	Noise	Sleepless Hours
Visual	T	A	T		
Numerical		A			TA
Cognitive		A			TA
Fine Motor Discrete	T	A	T		
Fine Motor Continuous					
Gross Motor Light	T		T		
Gross Motor Heavy					
Commo. (Read & Write)		A			
Commo. (Oral)	T	A		A	

T = affects task time, A = affects task accuracy, TA= affects both

* O'Brien, L. H., Simon R. and Swaminathan, H. (1992). Development of the Personnel-Based System Evaluation Aid (PER-SEVAL) Performance Shaping

IMPRINT Architecture - Maintenance Modeling



Who Has IMPRINT?

Army	108
Navy	23
Air Force	9
Other Government	12
	108
Contractors	19
University	

279 and growing

Soldier Centered Design Tools

Derivative Tools and Programs

MPT-DSS

NRC PHRED

UK & Canada IPME

AFRL CART

NAVSEA SMART

SEAPRINT

Maintenance and logistics MANCAP, KBLPS, IMPRINT

Task and Workload Analysis HARDMAN III, Crewcut, JASS, WinCrew, IMPRINT

Human figure modeling & sim. Jack, UNIPORT, ODT, TESF

Information flow C3Trace

Joint system of systems modeling

Sample Applications

NBC Fox

LW 155

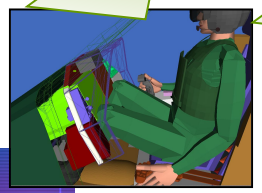
Comanche

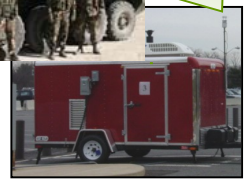
Stryker maint.

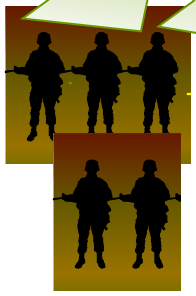
JBPDS

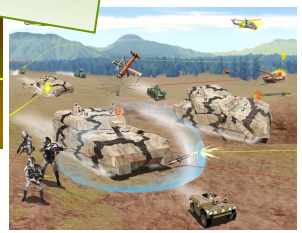
FCS crew size (2 vs 3)

Objective Force









IMPRINT Development

Challenges

- Decrease barriers to usage
  - Bi-modal set of users
  - User interface too broad and deep with addition of new features
  - Encourage valid analyses
  - Information assurance constraints (i.e. security)
  - Maintain platform compatibility
- Evolving analysis demands
  - Support System of Systems Analyses
  - Support analysis of joint operations
  - Consider alternative maintenance concepts (e.g. increased crew maintenance)
- Package more human factors R&D results

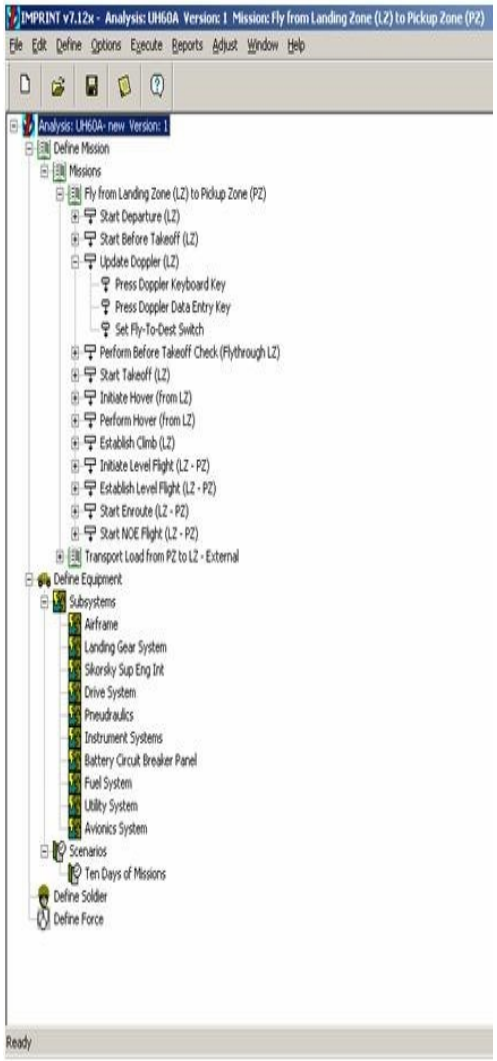
IMPRINT Development

- **IMPRINT 5.13a -** pre Oct 02
  - VACP, Performance Moderators, Maintenance
  - WinCrew advanced workload modeling
  - VGA GUI, 16 bit, Borland C++, Crystal Reports v5

- **IMPRINT 6.40c -** released Oct 02
  - goal oriented behavior & HLA compatibility from CART
  - VACP, Performance Moderators, Maintenance
  - VGA GUI, 16 bit, Borland C++, Crystal Reports v5

IMPRINT Development

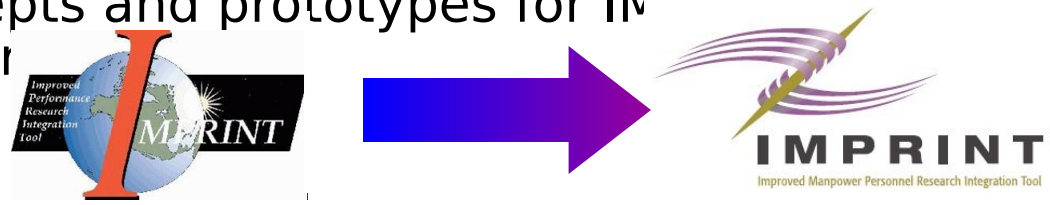
- **IMPRINT 7.12w – released Feb 04**



- **Upgraded assumed resolution from VGA to SVGA**
- **32 bit, Microsoft C++, Crystal Reports v7**
- **Added hierarchical navigation tree to GUI**
- **Updated personnel projection database (fr.1996 to 2002)**
- **Interface to add customized stressors**
- **Dynamic stressors through calls to external modules**
- **Enhanced maintenance model (flexibility LSA imports)**
- **Dynamically subscribe and unsubscribe entities to server**
- **Ability to synch to real time simulations**
- **Review input parameters and GUI (e.g. distributions)**
- **Review output, reports, and analysis aids**
- **New training materials (tutorial) and workshop**

IMPRINT: Development

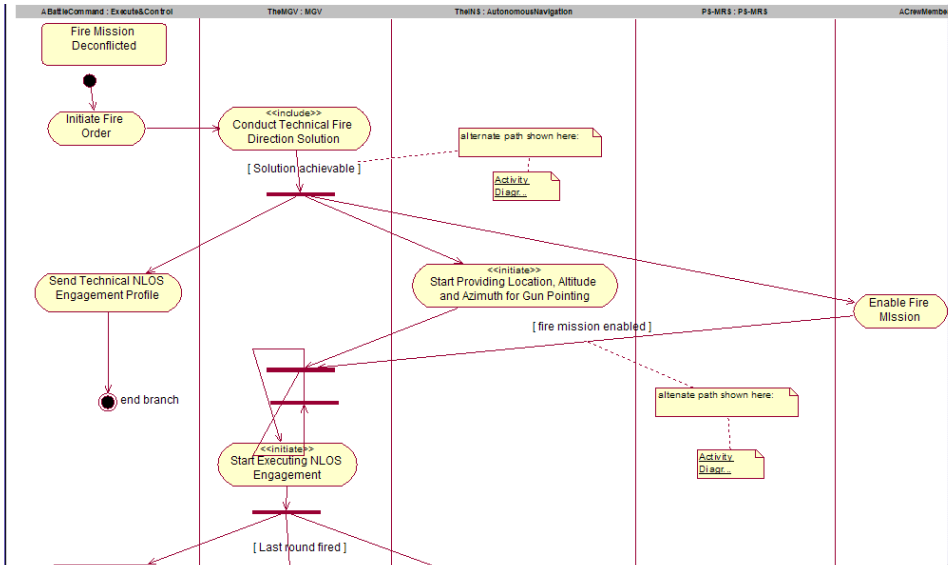
- Enhanced IMPRINT maintenance modeling
  - Improved the fidelity of modeling direct support maintenance
  - Increased capacity to model maintenance of complex systems (more components, systems, tasks) and more of those systems with longer scenarios
  - integrated transition between operator and maintainer analyses such that maintainability variables will directly impact operational system effectiveness.
- Developed concepts and prototypes for IMPRINT ver. 8 (two products, Standar



- Investigated the validity and robustness of dynamic human task scheduling constructs such as the WinCrew strategies, information processing/process control theory (IP/PCT), and goal oriented behavior modeling.
- Mapped IMPRINT taxons to skills and abilities in SkillsNET objects (thru Navy's SEAPRINT program)

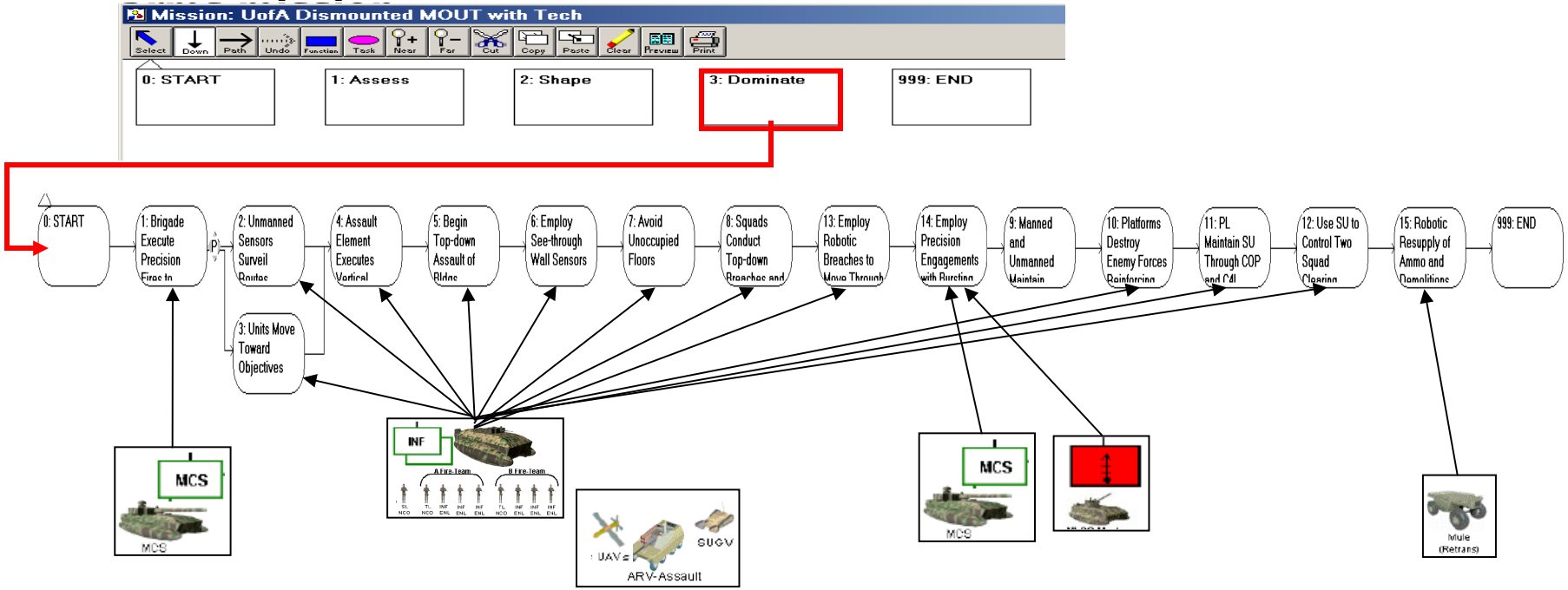
Tool Development, FY 04

- Develop specifications and beta versions for IMPRINT Standard and Pro
- Links with other tools and simulations
  - Automate links between IMPRINT and UML development applications.
  - Develop links and file format compatibility between IMPRINT and Army Evaluation Center (AEC) maintenance analysis tools such as COMPASS and SESAME. Test case = Sentinel forward area air surveillance system



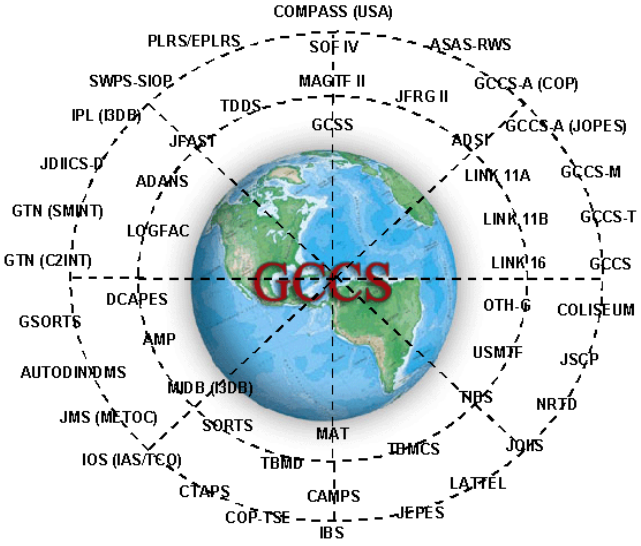
IMPRINT Development, FY 04

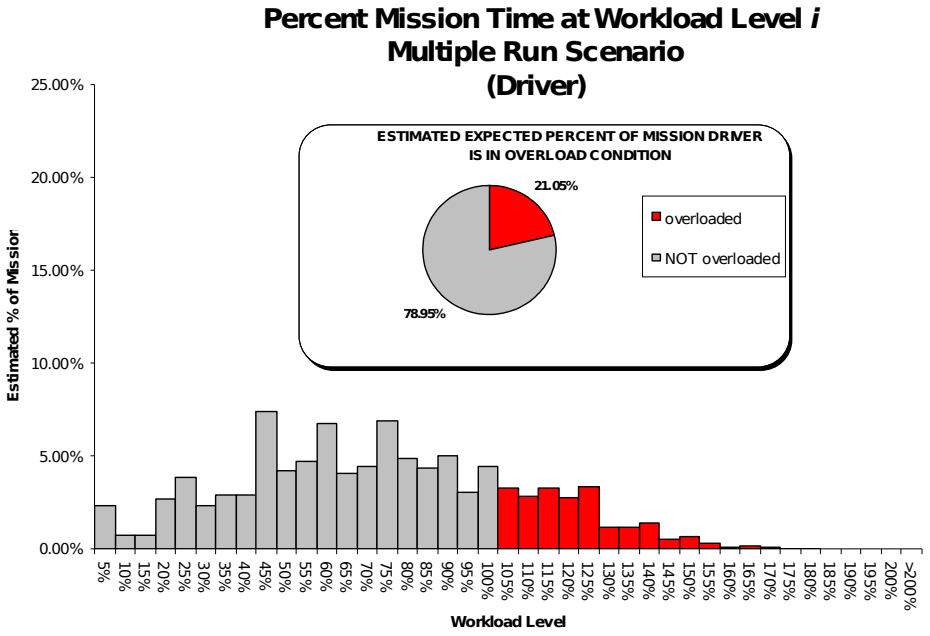
- **Links with other tools and simulations**
  - **Update the Command, Control, and Communications Human Performance Model (C3HPM) for inclusion in MATREX V0.5**
  - **Support development of the core MATREX Network Centric Warfare Simulation Environment (NSE) and FY05 MATREX Network Fires Thread.**
  - **Develop architectural specification for a system of systems level network of integrated IMPRINT models to simulate a combined**



IMPRINT Development, FY 04

- **Develop IMPRINT models to represent Military Intelligence operators in Battle Lab Simulations at the Ft. Huachuca Battle Command Battle Lab.**
- **Develop an interactive, constructive model of system capability as a function of Global Command and Control System (GCCS) operator effectiveness. (with SPAWAR)**
- **Extend output report and analysis aid enhancements to IMPRINT Pro**

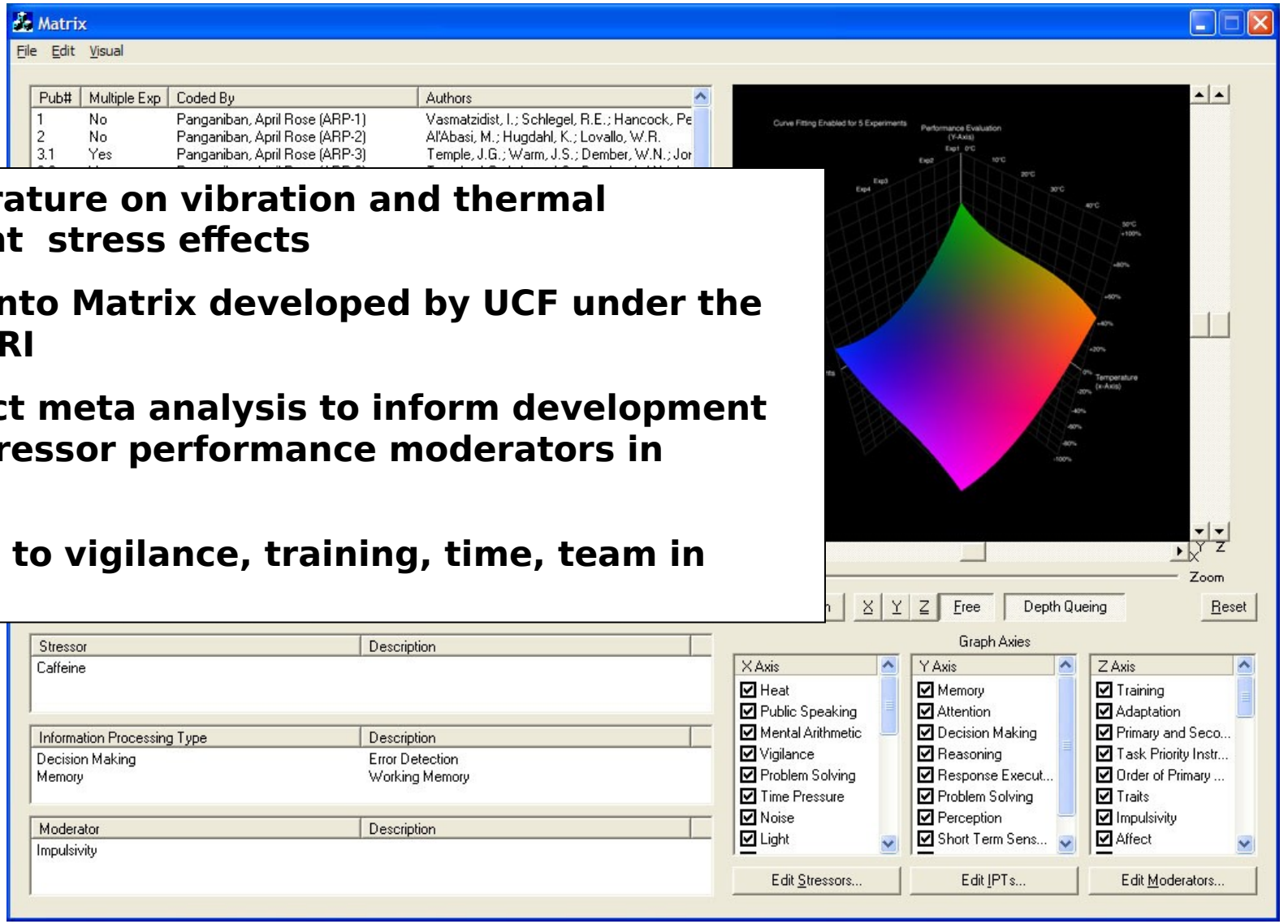




IMPRINT Development, FY 04

Codify literature on vibration and thermal environment stress effects

- **Enter into Matrix developed by UCF under the OPUS MURI**
- **Conduct meta analysis to inform development of new stressor performance moderators in IMPRINT.**
- **Extend to vigilance, training, time, team in FY05**



Updating IMPRINT Stressors

- **Options for Incorporating Changes to Performance Shaping Functions**

static

A. Change default algorithm in IMPRINT source code
  - Requires new release

B. Input new algorithm using "custom stressor" feature
  - No change to source code
  - User defined models only

dynamic

C. Use IMPRINT variables, beginning and ending effects
  - No change to source code
  - User defined models only
  - Greater user skill required

D. External Model Calls to more complex models
  - User defined models only
  - Greater user skill required

IMPRINT Development, FY 05

- Improve training performance moderators through collaboration with AFRL, Mesa
  - base on a richer empirical database
  - beyond frequency and recency of practice to content and media type
- Link to existing fatigue model such as SAFTE to consider:
  - circadian rhythms
  - cumulative effects
  - interaction between physical and mental fatigue
- Establish a link from IWARS to IMPRINT
- Validation studies
- Usability studies
- Links to perceptual and biomechanical models
- Update dynamic workload management strategies

IMPRINT Web Page

http://www.arl.army.mil/ARL-Directorates/HRED/imb/imprint/impr

Improved Performance Research Integration Tool
IMPRINT
IMPRINT
Improved Performance Research Integration Tool
Version 7 now available!
Links to other sites:
ARL Home Page
Dept. of the Army
WinCrew
Micro Saint
IPME
MATRIS
AMCOS
SAE
MANPRINT
ODCSPER - PAMXXI
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What is IMPRINT?
IMPRINT is a Human Systems Integration (HSI) and Manpower versus Hardware Integration (MANPRINT) tool developed by the U.S. Army Research Laboratory, Human Research & Engineering Directorate. It is a dynamic, stochastic discrete event network modeling tool designed to help assess the interaction of soldier and system performance throughout the system lifecycle--from concept and design through field testing and system upgrades. IMPRINT may be used in stand alone mode or models may be linked through external communication call protocols such as HLA. IMPRINT is the integrated, Windows follow-on to the Hardware vs. Manpower III (HARDMAN III) tools.
Why use IMPRINT?
As a system design and acquisition tool, IMPRINT can be used to help set realistic system requirements; to identify soldier-driven constraints on system design; and to evaluate the capability of available manpower and personnel to effectively operate and maintain a system under environmental stressors. IMPRINT is also used to target soldier performance concerns in system acquisition, to estimate soldier-centered requirements early, and to make those estimates count in the decision making process. As a research tool, IMPRINT incorporates task analysis, workload modeling, performance shaping and degradation functions and stressors, and embedded personnel characteristics data.
How does IMPRINT do it?
IMPRINT uses Micro Saint, an embedded discrete event task network modeling language, as its